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REVERSER ARCHITECTURE IN A LASER FUSION DRIVER

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The reverser laser architecture is designed into a concept for an Inertial Fusion Energy Plant, and the effect on Cost of Energy (COE) is evaluated. Laser fusion drivers have been studied at Lawrence Livermore National Laboratory with a QuickBASIC code called DPSSL*IFE (Ref. 1). This code models the performance of a 345-beam diode-pumped solid-state laser with an output power of 3.7 MJ of 351 nm wavelength light delivered on target every tenth of a second. With the balance of plant included, a 8.6¢ / kW·h COE is calculated. Using the same code and assumptions, the Q-switched laser architecture was replaced with a reverser architecture which enables multi beam passes with small mirrors and lenses rather than a large aperture Pockels cell and polarizer. The reverser optics are located near the beam focus in the spatial filter and turn the beam around after two passes through the amplifiers for another two passes. Because this is not a closed cavity, a Pockels cell and polarizer are not needed to switch the beam out of it. However, the Pockels cell and polarizer also provide isolation against back reflections in the Q-switched design, and this must also be accomplished in some other way.

To protect against back reflections in the reverser architecture, a mechanical beam isolator is installed near beam focus in the spatial filter. This device is several tens of centimeters in diameter and rotates at a speed sufficient to pass the shot beam but block reflections from the target. Mechanical beam isolators are not a new idea; they were considered for Nova (Ref. 2), but rejected because pinhole closure time was not quite fast enough. However, a greater than ten-fold increase in the strength of composite materials has enabled tip velocities of 2000 m/s in energy storage flywheels (Ref. 3), meeting beam isolation requirements. Extrapolation of this technology for a beam isolator in NIF is under study.

The COE was recalculated for this new architecture and found to be significantly less.

REFERENCES:
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